10/568,363

advantage that at microwave frequencies, manufacture and measurement of the properties is much easier.

Page 3, please amend the paragraph beginning on line ~~5~~ 6 as follows:

CH 6/23/08

In a photonic crystal, a waveguide can be created from a chain of equally spaced cavities or point defects along a certain direction of the crystal. This type of guide is known as a coupled cavity waveguide. The propagation along these guides is explained by photons jumping between adjacent cavities due to overlap of the evanescent field tails. The coupled cavity waveguides have certain characteristics that make them particularly interesting: on the one hand, a theoretical expression can be derived for the dispersion ratio of the guide modes from <u>a</u> tight-binding approach~~es~~ used in solid-state physics. On the other hand, transmission along curves with very tightly curved radii is very efficient provided that symmetry of the cavity mode is appropriate. In addition, the group velocity of this type of guide is very low, tending to zero at the edges of the band, and so highly efficient non-linear processes are expected in this type of guide, as well as high dispersion that could be of use in a number of applications.

Same page, line 13 from below, to page 4, line 13, please amend this paragraph as follows:

10/568,363

The photonic crystals can adopt any type of ~~network~~ lattice, particularly a triangular ~~network~~ lattice or square ~~network~~ lattice.

Same page, fifth paragraph, please amend this paragraph as follows:

To complement the description being made and in order to facilitate a better understanding of the characteristics of the invention, in accordance with a preferred example of a practical embodiment thereof, as an integral part of ~~said~~ such description, a set of figures is included in which, for illustrative purposes, and in no way limiting, the following has been represented:

Page 9, line ~~18~~ 19, to page 10, line 5, please amend this paragraph as follows: CU 6/23/08

In order to describe the present invention and offer results that verify the behavior, as a preferred embodiment, a 2D photonic crystal is chosen as shown in Figure **2**. This photonic crystal consists of a hexagonal ~~network~~ lattice with a ~~network~~ lattice constant *a* (distance between the center of the cylinders closest to one another) of dielectric cylinders (10) with a high refraction index (permittivity ε_1) and radius *r* on a medium (11) with a low refraction index (permittivity ε_2). The structure is periodic in the

R:\Patents\M\MARTI SENDRA ET AL-1 PCT\Prel. Amen.wpd

10/568,363

plane in which the cylinders are distributed and is described by the directions ΓK and ΓM, whereas it is constant in the direction perpendicular to the plane of periodicity. This photonic crystal has a forbidden band for modes with transversal magnetic polarization (TM), that is, modes with the electric field in the direction perpendicular to the plane of the crystal. This embodiment is selected for verification at microwave frequencies in the laboratory. However, the present invention could be realized in 2D crystals with square symmetry, with another transversal form of the cylinders, interchanging materials of high and low refraction index, and even using a 3D photonic crystal without losing its general characteristics.

Page 10, please amend the paragraph beginning on line ~~8~~ 7 as follows:

CH 6/23/08

Figure **3** shows an example of a waveguide (12) created in the 2D photonic crystal of Figure **2** by means of suppression of a row of cylinders ~~in~~ <u>along</u> the ΓK direction. On creating the guide, there is a mode with TM polarization confined to the linear defect with frequencies within the forbidden band, and so the linear defect acts as a waveguide. It is also possible to create a guide from coupled cavities (13) as shown in Figure **4**. In this case, a chain of cavities is created and propagation is due to photons jumping between

R:\Patents\M\MARTI SENDRA ET AL-1 PCT\Prel. Amen.wpd

10/568,363

coupler of Figure **5**. This is due to the fact that in the coupler of Figure **6**, the coupling is of the same order of magnitude in the longitudinal direction of the guides (ΓK) as in the transversal direction (ΓM), whereas in the coupler shown in Figure **5**, coupling is much stronger in the longitudinal direction due to a smaller separation between adjacent cavities. Thus, we have a large spectral region (24) in which only the odd mode exists and which can be used to implement the power divider with a phase difference of 180°. The spectral region where only the even mode is present (26) is not as ~~broad~~ wide, and the region where both modes coexist is almost indiscernible (25) due to extensive uncoupling. These are the results for the preferred embodiment, but a design could be drawn up in which the even and odd modes did not coexist in frequency and the whole of the region of the odd mode (23) would be available to implement the divider.

Page 13, line ~~11~~ 12, to page 14, line 4, please amend this paragraph as follows:

CH
6/23/08

In order to verify the nature of the power divider and 180° ~~dephasing~~ phase-shifting of the proposed method, in Figure 10 a simulation is shown with a method of finite differences in the time domain of the electric field distribution parallel to the axis of the cylinders for a monochromatic wave with a normalized frequency 0.44 (which lies in the operating range of the). On introducing this

10/568,363

signal into the input port (28), the signal reaches the section of the coupler that, in this case, consists of N = 6 cavities, and excites the odd mode. The field maxima are shown in white shades and the minima in black shades. It is observed that in the region of coupling, the maxima of one of the guides correspond to minima with the adjacent one, and vice versa, which confirms that the exciting mode is of odd symmetry. At the output, use is made of the property of spatial periodicity of the 2D photonic crystal to divide the guides of the coupler into two output points (29) and (30). The odd symmetry is maintained at the output ports, and so the phase difference between them is 180°. In addition, the path covered by the two signals through the structure is identical and so they are synchronized. This property is very important, as high speed signals can be used without delays at the outputs. If, for example, it is desired to implement a divider with a phase difference of 180° from a divider with a difference of 90°, this could be done by adding an additional path in one of the output ports that adds an extra phase difference of 90°. However, this ~~route~~ mechanism will also add to the propagation delay and so the condition of synchrony between output signals would not be met, unlike the proposed method.

Page 15, line ~~10~~ 11, to page 16, line 26, please amend this paragraph as follows: CH 6/23/08

The simulation method available does not allow phase measurements to be obtained and so the divider shown in Figure **9** was